another (*C. affinis*) which may descend to a depth of at least 1,300 fathoms.

THEO. GILL.

ELECTROMETER FOR THE STAGE OF THE MICROSCOPE.

THE capillary electrometer consists of a vertical tube drawn out at the lower end into a fine capillary and filled with mercury (Figs. 1 and 2). The upper end of the tube is joined to a cylinder in which a piston is

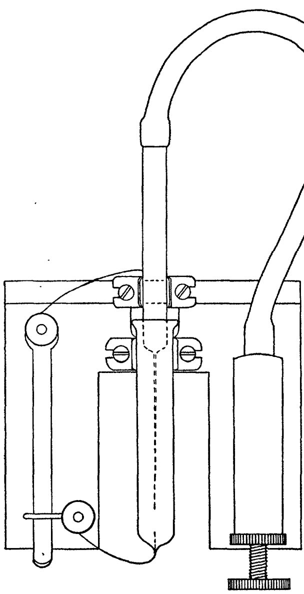

FIG. 1.

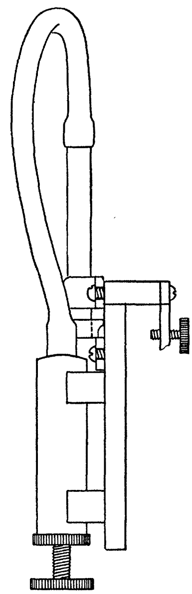

FIG. 2.

moved by a screw, thus making pressure on the mercury column. The end of the capillary dips in a reservoir containing 20 per cent. sulphuric acid. A little mercury is placed in the reservoir. Platinum wires lead from this and the mercury in the capillary to convenient binding posts. When mercury is placed in the vertical tube it enters the capillary until the weight of the column of mercury is balanced by the surface tension. If the capillary be now dipped in the reservoir containing the sulphuric acid and the piston driven upward by its screw, mercury will be forced out of the capillary into the acid, and on lowering the pressure the mercury will retreat within the capillary, drawing the acid after it. As the mercury in the capillary is kept from falling by the surface tension, it is obvious that whatever increases or diminishes the surface tension, for example an electric current, will raise or lower in corresponding measure the mercury in the capillary. The alteration in surface tension is accompanied by the movement of ions between the meniscus and the remaining electrode of the electrometer (the mercury in the acid reservoir). In practise it is found that this movement can be neither very rapid nor long continued, without injuring the sensitiveness of the instrument. The potential difference from even a single element (Daniell or dry cell) is far too large to be used safely. It is advisable to employ a potential divider, or rheochord, which shall permit only a fraction of the original potential (not more than 0.1 volt) to reach the electrometer.

The electrometer should be kept short-circuited, except during an observation, so that the capillary and the mercury in the reservoir may always be connected through a conductor. The short-circuit key is shown in Fig. 1. A strip of spring brass connected with one of the binding posts of the electrometer rests against a second piece of brass connected with the other binding post, except when depressed by the finger. The point of higher potential, when known, should always be connected with the capillary.

When the capillary electrometer is connected with two points of unlike potential the meniscus is displaced. The pressure necessary to bring it back to its original position is proportional to the electromotive force that displaced the meniscus. Thus by connecting the electrometer with known differences of potential it may be experimentally graduated. In practise, the relation between the pressure and the potential must frequently be redetermined. It is usually easier to measure differences of potential, such as the demarcation current of nerve or muscle, by compensation. In this method the electromotive force of the demarcation current is measured in fractions of a Daniell cell, or any other constant element, by bringing into the same cir-

cuit with the current of injury, but in an opposite direction, so much of the current from the cell as will exactly balance the current of injury, *i. e.*, so much as will keep the meniscus of the electrometer from moving in either a positive or a negative direction when connected with the circuit.

Numerous advantages are presented by the form of electrometer here shown. It fits the stage of the microscope. The microscope need not be tilted very far, and the observer is therefore in a comfortable position. The position of the electrometer on the stage may readily be changed. All the parts near the acid are of hard rubber, thus excluding currents that might arise from acid touching metal parts. The acid tube is flanged so that the acid can not creep out along the capillary tube. The capillary can easily be brought against the wall of the acid tube. The tube from which the capillary springs descends within the acid tube, thus protecting the capillary against breakage. Either tube may at once be removed from its holder. The platinum wires extend to the binding post, and are not simply short pieces soldered to copper wire. The wire to the capillary tube extends to the bottom of the tube, thus maintaining the contact until all the mercury in the tube is used.

About one cubic centimeter of paraffin oil should be placed above the piston. Only absolutely clean double-distilled mercury should be used.

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QUOTATIONS.

RESEARCH WORK IN GREAT BRITAIN.

EXPLAIN some remarkable discovery of pure science to the ordinary man and he instantly wants to know what is the use of it or casts about for some way of utilizing it for profit. He neither understands very clearly how the discovery was arrived at nor the importance it possesses apart from immediate application to the meeting of daily wants. Yet nothing is more certain than that the applications of science which most fully subserve the wants of man depend in every considerable case upon the results obtained by men who had no practical application in view. He who finds out merely for the sake of finding out everything that can be known about a given subject has so far contributed to laying the foundations of advance as it is understood by the practical man. Without the discoveries thus made the practical man finds himself balked at every turn. For practical applications depend upon the combination of a great many factors, and demand a power of selection from a vast body of ascertained facts which are supplied only by the seeker after knowledge for its own sake. Of the knowledge thus acquired no man can say what part will be first utilized, or how long any portion may remain useless for practical purpose. That depends very much upon the progress made by research in other directions, hence many important results have been lost to sight merely because some link was missing in the chain connecting them with other known facts. In that case they have to be rediscovered, otherwise they in turn become the missing links, and for want of them other knowledge remains sterile.

Now it is too true that in this country, as Professor Nuttall complains, research is not a career. Pure science does not bring bread and butter. This country has often been fortunate in having men of means who devoted themselves to research for the love of truth, and it has had men like Faraday, of great simplicity of life, who were not merely content, but glad, to live on the income of a clerk while making discoveries that subsequently changed the face of society. But we can not depend upon a constant and adequate supply of either type. The field is now very large and very costly to work. There are many temptations to turn aside which we must expect to be too much for most men who do not possess compelling genius. Hence, if we do not provide a living wage and adequate equipment for a sufficient number of seekers after knowledge, we must expect to be beaten in practical affairs by nations which better understand their true interests. The London school loses promising men who go into practice. In one way or another every branch of research loses promising men, who either go into